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ABSTRACT

Four studies were conducted to ascertain the long term effects of reducing class size in primary grades. Study One compared the effect of class size reduction on one school system when all students' scores were compared. Study Two was a repeated measures cohort study in which the scores of 193 students who had attended reduced size classes in the same school district for 3 years were compared to those of a similar number of students who had attended larger classes. Study Three examined the effect size of reduction in student/teacher ratio in 27 school districts in Southwestern Indiana. Study Four examined the effect of smaller classes on a statewide basis by comparing the mean scores on the state competency test. The clear and consistent indications of these comparisons of reduced size and regular size classes suggest that the long term effects of a state-sponsored class size program are negligible. It is concluded that, although this study and others have found no educational benefits for reduced size classes that can be translated to gains in achievement test scores, the Indiana experience does not necessarily imply that all state class size reduction programs are doomed to fail. Hastily implemented, PRIME TIME was not a well-conceived class size reduction program. Unless class size reductions are planned, teachers are trained, and programs are evaluated, smaller classes will very likely be a very inefficient and costly reform that will have little effect on student learning. (RH)

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The Longitudinal Effects of Smaller Classes: Four Studies

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The Longitudinal Effects of Smaller Classes: Four Studies

As education enters the 1990s, few problems will be more critical than the issue of class size. A majority of the states are now developing or implementing programs to follow the leads of Indiana's PRIME TIME or Tennessee's STAR. These programs have reduced class size in the primary grades of elementary schools. State-wide and nation-wide reductions in class size are very expensive, but teachers' unions, parent groups, and state legislators are promoting the belief that a smaller student/teacher ratio results in increased student learning. It is reasonable to assume that if and when these gains occur, they will be manifested by higher scores on basic skills achievement tests.

Some studies have demonstrated that students can achieve higher scores in grades one and two when they attend smaller classes.[1,2,3,4] However, as one of these studies has indicated, "...the gains we found were partially attributable to the novelty of the class size reductions, teacher expectations, or the belief (among teachers of smaller classes) that failure to produce gains could result in the punishing effect of a return to larger classes."[5]

The issue of optimum class size in public schools has been a topic filled with controversy. Passionate arguments have been presented both in favor of and opposed to the reduction in class size from the levels that were current. The controversy is filled with complicating factors, such as teaching style, subject taught, age of student, socioeconomic status of the student and a plethora of other factors. It is very difficult to find a definitive statement in the

literature regarding optimum class size and there have been as many opponents as proponents of class size reduction.

Research studies on class size date back as far as 1900. The question, "Are smaller classes better?" has been bothering teachers, parents, and administrators since that time. If someone were to ask whether smaller classes are better than larger ones, one would probably say, "Smaller is better." However, it is often the case that common sense may not necessarily be so.

There are several reasons that common sense would suggest that smaller is better. Among them are:

1. Teachers would have the energy and interest to give more concerned care and attention to each child if there are fewer in the classroom.

2. Classroom management is more effective when teachers spend more time with each student and keep track of individual progress.

3. Teachers will be able to employ a wider variety of instructional strategies, methods, and learning activities and can be more effective with them when class size is small.

4. Teachers' attitudes and morale are more positive when they have fewer students.

5. Small class size makes good use of time and space.

6. Teachers will be able to find more time to plan, diversify, and individualize their teaching.

7. As teacher attention, energy, and time are shared among fewer students, the environment will be more conducive to learning.[6]

A survey of the research done on the effects of class size on achievement would conclude that "until recently, the relationship

between class size and achievement has been inconclusive as some studies have favored smaller classes, others larger, and some have found no relationship between the two variables."[7]

Teachers have long felt that smaller classes are better. When teachers are asked what they would change in order to become more effective, they most often say that "they would decrease the number of students in their classes."[8] However, school boards have questioned whether class size reduction is a cost-effective measure having significant results. Cacha noted that if the sizes of classes are increased even slightly, the schools can sustain substantial savings. The debate continues in the hope that researchers can one day provide a definitive solution that can somehow coincide with political and economic considerations.[9]

As is the case in most controversies, there are opinions to reason why smaller class size does not produce uniformly positive results. Among these are:

1. What occurs in classes (beliefs and capabilities of the teacher, abilities and background of the pupils, subject matter, etc.) has a greater effect on achievement than class size per se.

2. Class size must be very small (below 14) before any dramatic increase in achievement will appear.

3. Few, if any, pupil benefits can be expected from reducing class size if educators continue to use the same instructional methods and procedures in smaller classes that they used in large classes.

4. Teachers' styles dictate the extent to which individual attention is given to each student, and most teachers do not take advantage of the small class to individualize instruction.

5. Reduced class sizes in the primary grades will increase teacher dependence and reduce self-discipline. The effect of this could be serious for students who must attend larger classes in later grades.

6. A typical finding in studies involving class size is that there are no significant differences in achievement of large versus small classes.

7. To assign all teachers in a school system to classes of less than 20 students would be very expensive.

8. Teaching alternatives (aides, split schedules, etc.) have not been demonstrated to be effective in practice.

9. The positive effects of small classes merely reflect laziness and the issue is a political ploy to make teaching less work and to increase the number of teachers.

10. Instructional effectiveness is more dependent on the teacher than on class size.

11. The financial costs and political consequences make the class size reduction alternative prohibitive.[10]

These four studies represent an effort conducted by a local school corporation to ascertain the long term effects of reducing class size in primary grades. These studies attempted to ascertain the longitudinal effects on local, regional, and State-wide bases.

If reducing class size is an effective means for increasing student achievement, then the means of test scores for students in smaller classes should be significantly higher than the means of test scores for students in larger classes.

OBJECTIVES OF THE STUDIES

1. To ascertain the longitudinal (3 year) effect of class size reduction on student achievement in a local school district.

2. To determine whether the results of this study were affected by students who transferred in or out of the school district.

3. To investigate, through meta-analysis, whether student achievement was affected in a region comprising approximately one fourth of the State. Through meta-analysis, it was also possible to find the size of the effect that class size reduction has had on achievement test scores.

4. To examine test scores on the State Basic Skills Competency Test in an attempt to discover the impact of class size reductions on academic achievement on a State-wide basis.

5. To determine the grade levels and subject matter areas in which class size reduction has demonstrated the greatest effectiveness.

THE FOUR STUDIES

Study One, A Longitudinal Comparison for a School District

Method

Scores on a variety of tests were used to compare the achievement of groups of primary students who had enrolled in Indiana's Project PRIME TIME with the achievement of cohort groups who had received instruction in larger classes prior to PRIME TIME. The tests were the Iowa Test of Basic Skills (ITBS), Reading, Mathematics, and Composite Subtests for grades 1, 2, and 3; the Indiana Basic Skills Competency Test (IBSCT) for grade 3; Local Skills Tests in reading and mathematics for grade 1; Affective Measures of Self Concept and Attitude Toward School and the total of these two measures for grade 1; and the Social Studies and Science Supplements of the Iowa Test of Basic Skills for grade 3.

Results

There were significant differences favoring the smaller classes on the Local Skills Tests, all three affective measures and all ITBS scores for grades 1 as well as for all ITBS scores for grades 1 and 2. In grade 3, however, the math subtest of the ITBS was the only one of the six subtests that showed significant differences favoring the smaller classes. Neither the Reading, Social Studies, Science, or Composite subtest scores favored the smaller classes. For the grade 3 Indiana Basic Skills Competency Test, there were no significant differences on any of the subtests that favored either group.

Grades 1 and 2 showed a decrease in the amount of significance as compared to the dramatic gains demonstrated during the first years that large class and PRIME TIME groups had been compared.

Study Two, A Repeated Measures Cohort Study

Method

The design for the study was a repeated measures cohort study. Students who received large class instruction for three years were compared with students who had received reduced class size instruction for three years.

Subjects were 193 students, each of whom had attended the first, second, and third grades at a school district in Southwestern Indiana. The community is varied in socioeconomic background, and parents of the students work at a variety of occupational levels. Subjects were administered the Iowa Test of Basic Skills (ITBS) from 1985 to 1987 in grades one, two, and three. The difference in class size between the larger class and the smaller class group was 3.8 students in the first grade, 3.1 students per class in the second grade, and 6 students in the third grade.

The subtests compared were reading, math, and composite. Only those subjects who had scores available for all three years of the study were used in the analysis. In this way, students who entered or left the school district during the study were eliminated from the analysis.

Results were analyzed for statistical significance by a repeated measures analysis of variance which included grades one, two, and three. The final results for the third grade testing was further analyzed by analysis of variance to determine the overall treatment effect of the three years of the study. The BIOMED statistical package was used for all computations.

Results

The analyses of variance and covariance with repeated measures generated results at each of the grade levels (one, two, and three) and in each subtest (reading, math, and composite). These results are presented by grade and subtest in Table I. Figure 1 displays the data in graphic form.

Grade one was the first year that the PRIME TIME subjects were enrolled in the state-sponsored reduced class size program. Group mean scores for the Large Class and Prime Time group respectively were as follows: reading 71.5/75.2, math 66.2/76.5 and composite 75.0/79.9 respectively. At this grade level, statistically significant increases in academic achievement favoring the PRIME TIME group were evident across all three subtests. The actual levels of probability for the subtests were Reading $p < .001$, Math $p < .002$, and Composite $p < .004$.

In grade two, statistically significant increases for the PRIME TIME group were again produced on the math and composite subtests. However, the results for the reading subtest were not statistically significant. Group mean scores for the Large Class and PRIME TIME groups were: Reading 69.9/72.4, Math, 58.3/71.6, and Composite 68.6/77.5. Actual levels of probability were: Reading $p < .27$, Math $p < .0003$, and Composite $p < .004$.

In grade 3, however, there were no statistically significant differences at the .05 level between the Large Class group and the PRIME TIME group on any of the subtests. Mean reading scores for the PRIME TIME group (m=64.6) were actually lower than the large class group scores (m=66.0) but not significantly lower ($p < .64$). Mean

Table 1 — Results on Iowa Test of Basic Skills for Large Class Cohort and PRIME TIME Cohort, First Grade Through Third Grade

READING SUBTEST

	First Grade			Second Grade			Third Grade		
	mean	sd	size	mean	sd	size	mean	sd	size
Large Class	71.5	19.9	23.7	68.9	21.2	20.5+	66.0	20.9	24.0
PRIME TIME	75.2	17.8	19.9	72.4	22.5	17.4	64.6	23.6	18.0
F ratio	6.04			1.22			-0.22		
p<	.001			.27			.64		

MATH SUBTEST

	First Grade			Second Grade			Third Grade		
	mean	sd	size	mean	sd	size	mean	sd	size
Large Class	66.2	23.7	23.7	58.3	26.1	20.5	71.1	23.1	24.0
PRIME TIME	76.5	22.3	19.9	71.6	24.1	17.4	74.9	21.1	18.0
F ratio	9.54			13.67			1.38		
p<	.002			.003			.24		

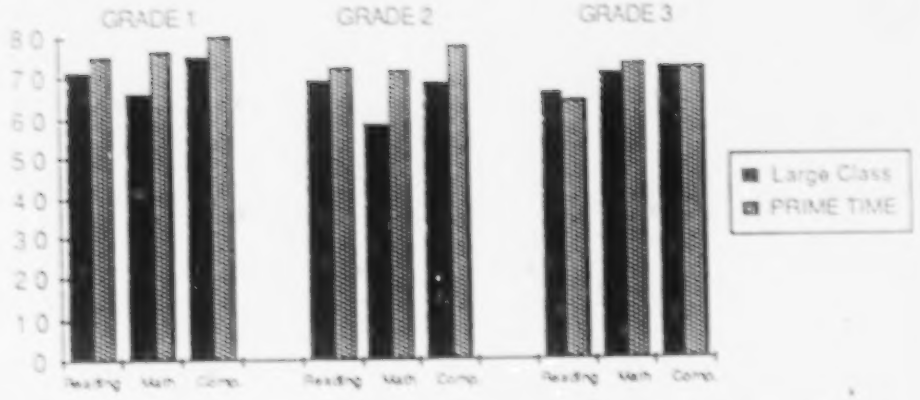
COMPOSITE SUBTEST

	First Grade			Second Grade			Third Grade		
	mean	sd	size	mean	sd	size	mean	sd	size
Large Class	75.0	16.7	23.7	68.6	22.4	20.5	71.9	19.5	24.0
PRIME TIME	79.9	17.1	19.9	77.5	19.6	17.4	72.2	20.4	18.0
F ratio	4.12			8.51			0.01		
p<	.04			.004			.91		

scores were not significantly higher for the PRIME TIME group in the Math Subtest (71.1/74.9) or the Composite Subtest (71.9/72.2).

The slight gains experienced by the PRIME TIME group in science ($p < .18$) and social studies ($p < .41$) were not large enough to be statistically significant.

Figure 1.—Results on Iowa Test of Basic Skills, Large Class Cohort and PRIME TIME Cohort, Grades One-Three



Study 3. A Meta-Analysis to Ascertain Effect Size

Method

For the purpose of this investigation, a study consisted of the analysis of a test or test battery for one school. A school system that reported separate results for different schools yielded as many studies as there were schools in the school system.

The data for the effect size computations were from 76 comparisons of achievement test results for 27 randomly selected schools. Scores for a total of 2,333 students were analyzed for the larger class group and were compared to the scores of a total of 2,272 students in the smaller class group.

According to the 1980 U.S. census information, the majority of the population in the communities of Southwestern Indiana reside in rural or suburban areas of 5,000 or fewer residents. The majority of parents of these students are wage and salary workers, local government employees, and farmers. The median years of school completed by residents there is approximately 12.3; the average family income ranges from $12,000 to $23,000; and between six to ten percent of the households are below the poverty level. Although 40 percent of the state population resides in such areas, characteristics of race, education, and income are comparable to State demographics.

The specific groups for this investigation were third grade students for the school years of 1985-86 and 1986-87. The former groups had averaged 26.9 students per class and had experienced no class size reduction because they had begun their schooling before

the program was implemented. The latter group, which averaged 19.1 students per class, had been instructed in PRIME TIME classes during their first, second, and third grade years. Thus, the results of this study demonstrated the cumulative three year effect of being instructed in large classes as compared to being instructed in smaller PRIME TIME classes.

These studies analyzed the results of mean scores from four achievement tests. The Iowa Test of Basic Skills, the Stanford Achievement Test, and the California Achievement Test are batteries that are frequently used to measure basic skill achievement in elementary schools. All of these measures yield subtest scores in reading, mathematics, and a composite (or complete) score that is a weighted synthesis of the scores from subtest batteries. During the academic years from 1984-85 through 1986-87 all of the schools in Indiana administered the Indiana Basic Skills Competency Test (IBSCT). The IBSCT was developed by CTB-McGraw Hill and yields subtest scores for reading, mathematics, and writing in addition to a composite score which is a weighted average of the subtests.

A random sample of elementary schools in Southwestern Indiana were asked to participate in the study by providing scores of whatever achievement test they had administered to the third graders in their school system during the 1985-86 and 1986-87 academic years. All schools that were contacted agreed to participate. Students' names were omitted from the summaries to ensure privacy.

An estimate of effect size was computed by taking the absolute value of the difference between the means of the two comparison

groups and then dividing by the pooled standard deviation of the two groups.[11]

The total effect size for each of the subtests was computed by taking the mean effect size.[12] Effect sizes were computed for reading, mathematics, writing, and composite subtests. Not all students were tested in all of the subtest areas, so computations of effect size were made whenever students at a school were tested in a specific area.

A positive value for the effect size determination would indicate an effect in favor of the PRIME TIME group.

The actual implementation of PRIME TIME classes in a school was used to operationally define the change from larger to smaller classes. However, three schools were eliminated from consideration because their were actually larger classes for the PRIME TIME groups than had occurred in previous years. Thus, the collapse of information alleged by critics of earlier meta-analyses[13] was minimized by the relative interstudy homogeneity of the investigations that remained.

Results

The means, standard deviations, and sample size for the comparisons in each of the studies as well as the estimated effect size for each study were computed. Summarizing the results, it was observed that of the 26 comparisons made for the Reading Subtest, 14 favored the smaller classes and 12 favored the larger classes.

For the Mathematics Subtest, 14 of 26 comparisons favored the smaller PRIME TIME classes. A total of 12 favored the larger classes.

The analysis for the few schools that reported Writing Subtest scores was also performed. Only one of the five comparisons favored the smaller classes and there were four comparisons in which the larger classes attained higher mean scores.

The Composite (or Complete) Subtest scores favored the PRIME TIME classes in 10 of the 20 comparisons that were made. However, there were also 10 comparisons that favored the larger classes. Composite scores were not reported by seven of the schools.

For the total of all comparisons, 39 favored the PRIME TIME Group and 38 favored the larger classes.

The summary statistics for the total effect size when all of the comparisons were combined for each of the subtests is contained in Table II.

From Table II, it can be observed that the effect size for reading was +0.02 standard deviation units, the effect size for mathematics was -0.01 standard deviation units, the effect size for writing was -0.13 standard deviation units, the Composite Subtest had a +0.001 standard deviation unit effect size, and the total for all comparisons was +0.01 standard deviation units.

TABLE II

Weighted Means of Effect Sizes in Standard

Deviation Units for Subtest Scores

	EFFECT SIZES	NUMBER OF SCORES		NUMBER OF COMPARISONS			MEANS (Unweighted)	
		LARGE CLASS	PRIME TIME		Fav. Large	Fav. P.T.	LARGE CLASS	PRIME TIME
READING	0.02077	2304	2246	26	12	14	59.15	59.53
MATH	-0.01230	2303	2278	26	12	14	55.24	55.80
WRITING	-0.134	431	454	5	4	1	54.00	52.42
COMPOSITE	0.001	1808	1778	20	10	10	97.95	99.005
TOTAL	0.0131	7098	6929	77	38	39	67.995	68.433

Study 4. A State-wide Comparison of Competency Test Results

Method

This study used the 1985-86 and 1986-87 reports on the results of the Indiana Basic Competency Skills Test (IBCST) for the data base. These reports had been generated from data collected by the Center for School Assessment, Indiana Department of Public Instruction. For this study, all of the test scores from the State were contained in the data analyzed and were, in essence, those of the entire population of third grade students in the State of Indiana.

Two groups were compared. The 65,911 third graders of 1985-86 received no class size reduction. The 67,973 third graders of 1987 were enrolled in classes which had experienced three years of the state-wide PRIME TIME program and were, therefore, the "experimental" group. Both groups were tested with the IBCST and their mean scores were compared for reading, math, and composite subtests.

Because the data were for the entire population of almost 134,000 third graders, any differences that occurred would be of statistical significance, but a small difference would not be of any practical significance. In addition, an F test for homogeneity of variance was performed. Results were tested at the .05 and .01 levels of significance.

Results

The means of the scores for the two comparison groups are contained in Table III. There was a gain of one point in both the Reading and Math Subtest Scores, but a loss of one point on the Writing Subtest Score. When a weighted formula was used to determine

Table III

IBCST Mean Scores

3rd Grade

		Reading	Math	Writing	Composite
1986	$\bar{X}$	56.8	35.0	29.2	118.0
	σ				14.99
	n	65611	65870	65756	65466
1987	$\bar{X}$	57.9	36.0	28.2	118.7
	σ				14.05
	n	67973	67987	67846	67700

$z = 2.09$ when composite means of 118.7 and 118 were compared
(Significant at the .01 level)

Table IV

Partial Distribution of Scores

Scores greater than 133 = 3816/65466 Scores between 118 and 132 = 38837/65466	
Scores greater than 133 = 2218/67700 Scores between 119 and 132 = 41549/67700	

F value for homogeneity of variance = 1.138
(Significant at the .01 level)

the Composite Score, there was a gain of only 0.7 points from 118.0 to 118.7. Thus, the results of the scores of the four subtests that were included in the composite scores only yielded a 0.7 point difference between the two groups. Because the distribution of composite scores "looked" different in 1987 than in 1986, a test for homogeneity of variance was performed. The results of this comparison are contained in Table IV.

An F value of 1.138 was obtained, which was significant at the .01 level. This result indicated that the variation of scores was greater in 1986 for the larger classes than it was in 1987 for the smaller classes. This is an indication that there was a tendency in the PRIME TIME group for the scores to regress to the mean.

CONCLUSIONS

This group of research studies was conducted by one school system in an attempt to ascertain whether the very expensive administrative exercise of decreasing class size in primary grades has been effective in increasing student learning, as measured by achievement test scores.

Results were as follows:

Study One compared the effect of class size reduction on the school system when all students scores were compared. This comparison included the scores of students who had moved in or had moved out of the school system. The gains that were noted in grades one and two for these students had disappeared by the end of the third grade except for one mathematics subtest which favored the smaller classes. There were no significant gains in Reading, Composite, Science, or Social Studies Subtests of the ITBS and no significant gains on any of the IBSCT subtests.

Study Two was a cohort study in which the scores of 193 students who had attended reduced size classes in the same school district for three years was compared to a like number of students had attended larger classes there. The highly significant gains that were evident during the first year of the program as well as the significant gains in some areas during the second year had completely disappeared by the end of grade three.

Study Three examined the effect size of reduction in student/teacher ratio in 27 school districts in Southwestern Indiana. The results indicated that the effect of class size reduction was

extremely small with as many comparisons favoring the larger classes as favored the smaller classes.

Study Four examined the effect of smaller classes on a State-wide basis by comparing the mean scores on the state competency test. The 0.7 gain on a composite of four subtests was negligible.

The clear and consistent indications of these comparisons of reduced size and regular size classes suggest that the long term effects of a state sponsored class size program are negligible. Studies one and two demonstrate the initial impact of state sponsored class size reduction programs, but raise questions concerning their long term effectiveness, particularly after the novelty of smaller classes has subsided.

Although this study and others have found no educational benefits for reduced size classes that can be translated to gains in achievement test scores, the Indiana experience does not necessarily imply that all state class size reduction programs are due to failure.

PRIME TIME was not a well conceived class size reduction program and was hastily implemented. There was only a nominal effort to train a few classroom teachers to instruct in ways that would take advantage of smaller classes. The early efforts to evaluate the progress of the program were hastily cancelled. Since then, little has been done by the Indiana Department of Education to determine the effects of smaller classes on educational achievement or to train teachers in how to utilize smaller classes to improve their teaching.

Unless wholesale class size reductions are accompanied by planning, training of instructional personnel, and planned

evaluations. It is logical to conclude that smaller classes are "a very inefficient and costly reform that will have little effect on student learning."[14]

Many questions remain to be answered in the dilemnas concerning how successful reducing class size can become and whether continuation of smaller classes will be assured. The answer seems to be a positive one, because even in the absence of research to substantiate it, the movement is very popular among teachers, parents, and politicians and smaller classes will be the trend for years to come. Politicians, teachers, and parents are not asking questions about effectiveness and nobody else seems to notice...or care... whether reducing class size will ever become a cost effective and beneficial advantage or will continue to be just another in a long line of meaningless administrative exercises.

REFERENCES

1. E. Swan, W. Stone, and D. Gilman. "The Educational Effects of a State Supported Reduced Class Size Program". ERS Spectrum. 5. 4. (Fall, 1987): 20-23.

2. D. Gilman and R. Antes. "The Educational Effects of the Introduction of a State Supported Reduced Class size Program. ERIC: Resources in Education (August 1987).

3. E. Whittington, H. Bain and C. Achilles. "Effects of Class Size Reduction on First Grade Students". ERS Spectrum. 3, 4 (Fall 1985): 33-39.

4. J. McGiverin, D. Gilman, and Chris Tillitski. "A Meta-analysis of the Relation Between Class Size and Achievement". The Elementary School Journal. 90 (Fall, 1989): 47-57.

5. Ibid. p. 56.

6. E. Swan et. al (1987) op. cit.

7. Ibid.

8. A. G. Down. "Does Class Size Make a Difference?". Instructor, 89, (1979) 22.

9. F. B. Cacha. "The Class Size and Achievement Controversy". Contemporary Education. 54. 1 (Fall, 1982): 13-16.

10. Ibid.

11. F. Wolf. Quantitative Methods for Research Synthesis. Beverly Hills, CA. Sage Publications. (1986), p. 23-36.

12. Ibid.

13. Educational Research Service. "A Critique of Recent Meta-Analysis". Phi Delta Kappan. 62. 4 (December, 1980): 239-244.

14. T. M. Tomlinsons. Class size and Public Policy: Politics and Panaceas. (Washington, D. C.: U. S. Department of Education. Office of Educational Research and Improvement).1988.

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